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NEW PRIMNOID GORGONIANS (COELENTERATA: OCTOCORALLIA) FROM ANTARCTIC WATERS

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ABSTRACT

Two new genera and species of the gorgonacean family Primnoidae are described and illustrated by scanning electron micrographs. Reproductive polyps of both *Tokoprymno maia* new genus, new species and *Aglaoprimnoa stefanii* new genus, new species, are adapted for brooding the young through early stages of larval development. *A. stefanii* is similar in gross appearance to *Armadillogorgia cyathella* Bayer, 1980, with which it is compared.

Operations of USNS ELTANIN in Antarctic waters 1962–1972 under sponsorship of the U.S. Antarctic Research Program resulted in a rich collection of octocorals. Especially well represented is the gorgonacean family Primnoidae, which flourish in polar waters both north and south and in deeper waters of intermediate latitudes. Two species of that family, both representing new genera, are described below. Supplementary information is provided for a third species previously known only from an incomplete specimen.

Family Primnoidae
Tokoprymno, new genus

Diagnosis.—Irregularly branched Primnoidae with polyps more or less biserial but not in pairs, directed toward one side of the branches. Vegetative polyps tall, straight, somewhat wider distally; operculum conical, usually very prominent when closed; marginal scales 8, nearly equal in size, directly aligned with operculars; body scales aligned in spirals; brood polyps ovate, losing opercular scales upon discharge of planulae.

Type Species.—*Tokoprymno maia*, new species.

Etymology.—Greek τοκος, birth + Prymno, one of the Oceanids, in allusion to the conspicuous brood polyps. Gender feminine.

Remarks.—In Kükenthal's (1924) arrangement of primnoid subfamilies, this genus falls into the Callozostrinae, which have vertically placed polyps not bent inward toward the axis. In that subfamily, the only genus having any similarity to *Tokoprymno* is *Parastenella* Versluys, 1906, which also has eight marginal scales. However, in that genus the marginal scales alternate with the operculars and have a marginal point or spine, whereas in *Tokoprymno* the marginals are aligned with the operculars and have no marginal spine.

Although octocorals in general have been considered oviparous, a number of species have been found to brood their eggs through the early stages of development and produce larvae well advanced at birth (Thomson and Henderson 1906a: 504; 1906b: viii). Three species of Gorgonacea are among those recorded by Thomson and Henderson, none of them belonging to the family Primnoidae.

Tokoprymno maia, new species
Figures 1–4

Material Examined.—Southeastern Pacific Basin: 54°49′S, 129°48′W, 549 m, USNS ELTANIN sta. 1346, 7 Nov 1964. One colony complete with holdfast attached to scleractinian coral, USNM 81535

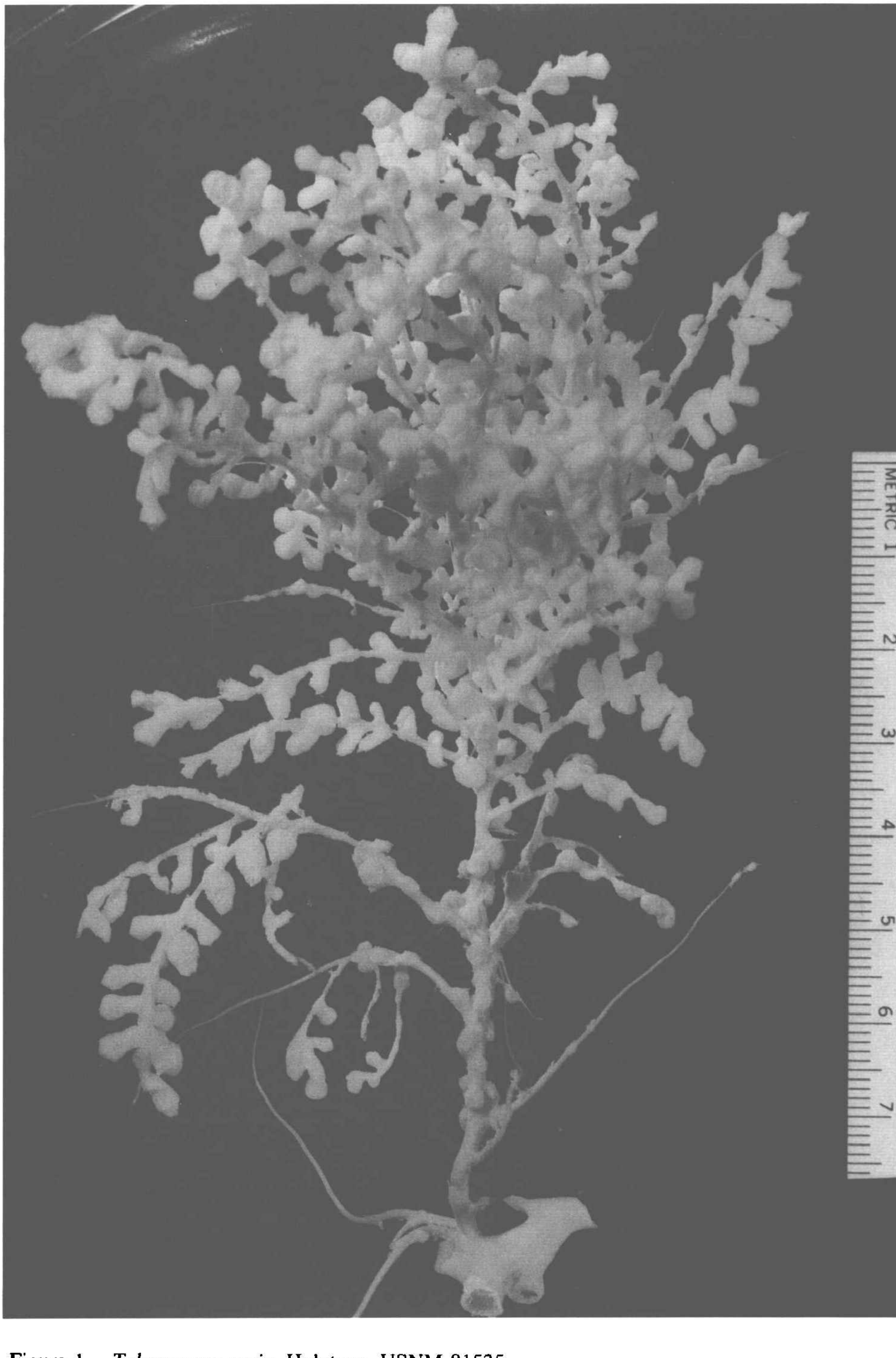

Figure 1. *Tokoprymno maia.* Holotype, USNM 81535.

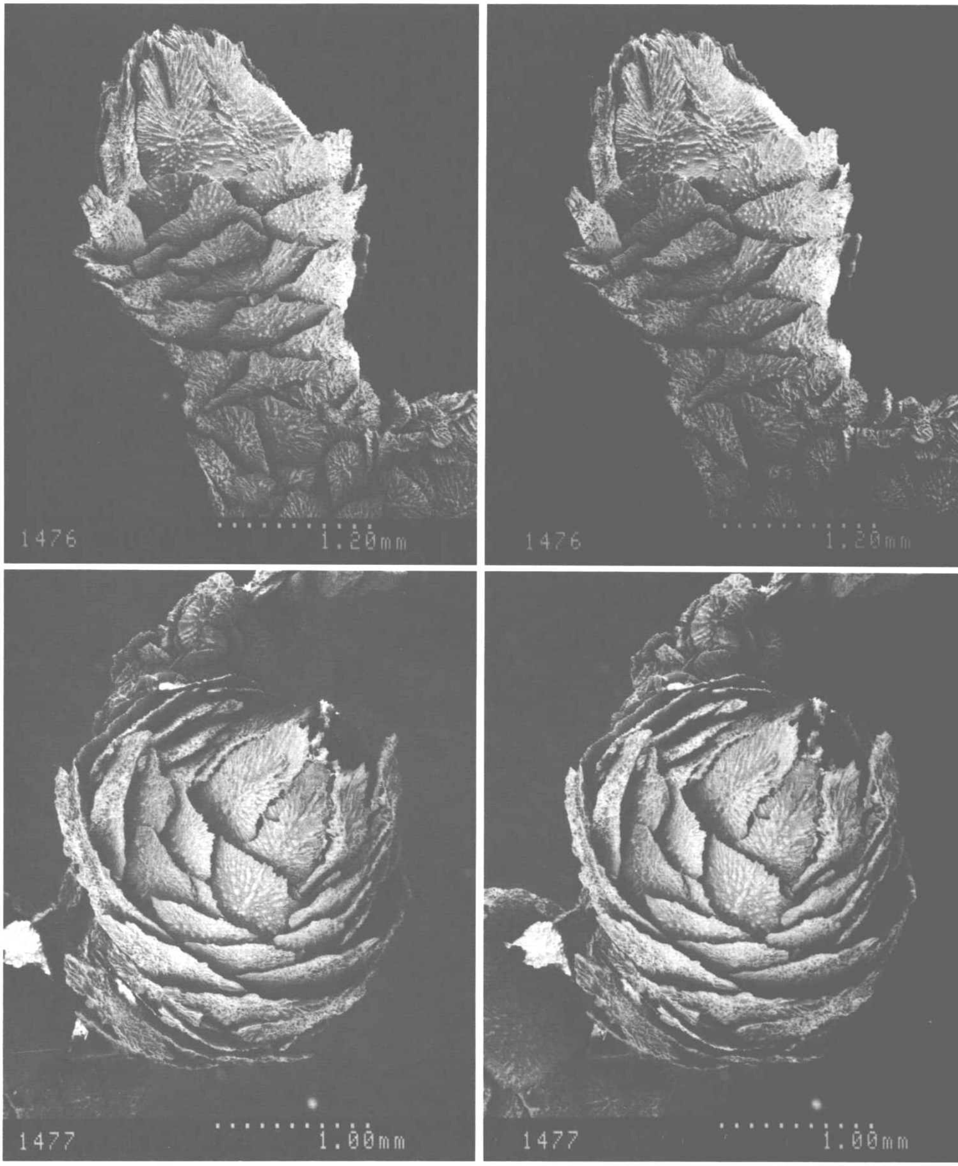

Figure 2. *Tokoprymno maia.* Top, Vegetative polyp; Bottom, Brood polyp with operculum intact. Stereoscopic pairs.

(holotype; SEM 1476, 1477), three smaller colonies of which two are somewhat damaged, and fragments, USNM 82976 (paratypes).

Diagnosis.—As for the genus.

Description.—The holotype (Fig. 1) is a nearly complete colony 12 cm tall, attached to scleractinian coral by a very narrow holdfast only slightly wider than the main trunk. Branching begins immediately above the holdfast and produces an untidy bush with branches arising at irregular intervals on all sides of the main

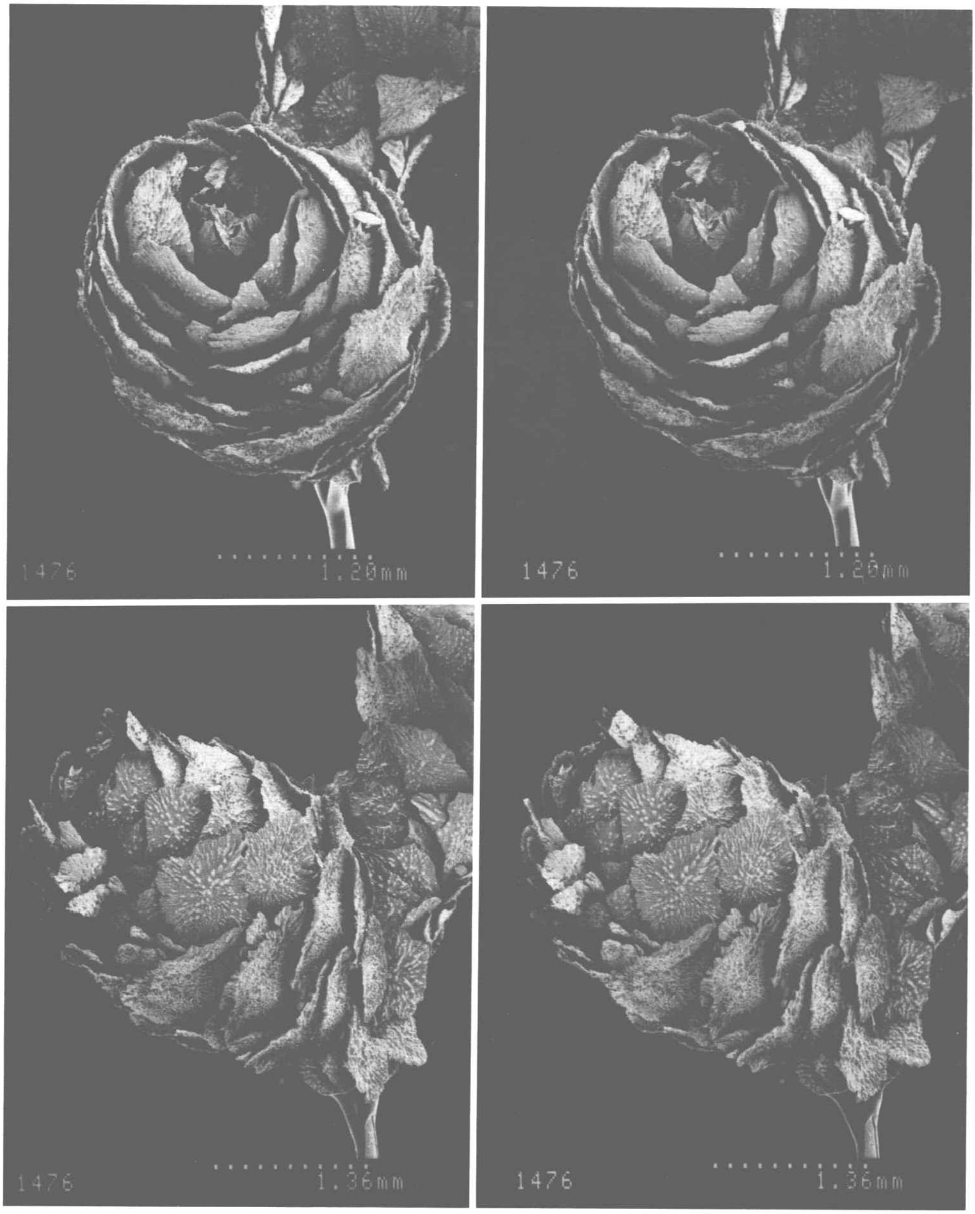

Figure 3. *Tokoprymno maia.* Oblique and lateral views of brood polyp lacking operculum. Stereoscopic pairs.

stem. The axis is calcified, smooth, cream-white in color, with scant metallic gloss and only vague indication of longitudinal striation.

Polyps arise in a generally biserial arrangement, directed toward one side of the branches, 4–6 in 1 cm; they are of two kinds: upright, nearly straight vegetative polyps 3–5 mm tall, distally somewhat flared and trumpet-shaped, with conical operculum (Fig. 2, top); and ovate, swollen, brood polyps about 3 mm tall and 2.5 mm wide (Fig. 2, bottom), often lacking operculum (Fig. 3) and

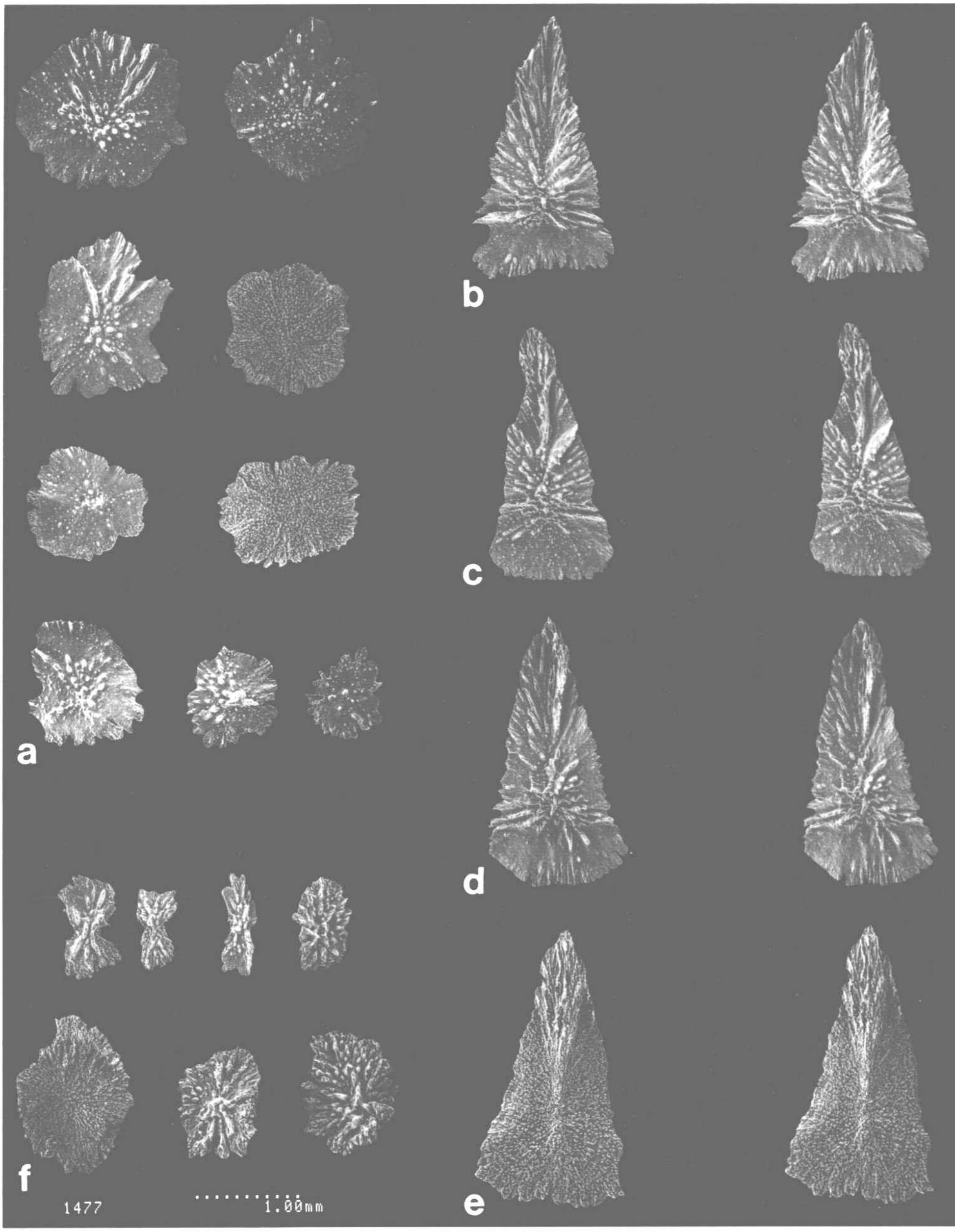

Figure 4. *Tokoprymno maia,* sclerites: a, Body scales; b–e, Opercular scales, stereoscopic views; f, Coenenchymal scales.

containing several larvae in various stages of development. One brood-polyp dissected contained 13 planulae of various sizes, the largest nearly 3 mm long and about 0.7 mm wide, as well as numerous developing eggs. Apparently the large size of the larvae results in damage to the oral region and loss of opercular scales during planulation.

The body scales (Fig. 4a) are large, thin, roughly squarish in outline with serrate

margins, the outer surface sculptured by more or less sharp granules extending radially from the center of deposition ("nucleus"), the inner surface by crowded complex tubercles indistinctly radially arranged. They decrease in size toward the base, where they merge with the scales of the coenenchyme, many of which are thicker than the body scales. Each of the eight marginal scales is aligned with an opercular scale. The opercular scales are nearly equal in size, shaped like an isosceles triangle with rounded basal angles, externally sculptured by prominent serrate ridges radiating outward from the center of deposition (Fig. 4b–d); they have a strong, laciniate apical keel on the inner surface, which elsewhere is sculptured by crowded tubercles (Fig. 4e). The coenenchyme contains a layer of smaller, irregular scales (Fig. 4f); the inner layer immediately surrounding the axis is devoid of sclerites.

Etymology.—From Greek μαια, nurse or midwife. Noun in apposition.

Aglaoprimnoa, new genus

?*Amphilaphis.*—Stibane 1987: pl. 1, fig. 2.
not *Amphilaphis* Studer [and Wright] 1887:50.

Diagnosis.—Large, sparsely dichotomously or laterally branched Primnoidae with long, stout terminal branches. Polyps in regular whorls, directed upward, bent inward and appressed to axis in contraction; sclerites of polyps numerous, placed around body in spirals, longitudinal arrangement obscured by intercalation of scales between original eight rows. Body scales externally concave, fan-shaped; outer layer of coenenchyme with small, saucer-shaped scales and tuberculate bodies with outwardly-directed crests; deeper coenenchyme and walls of stem canals with small tuberculate spheroids.

Type Species.—*Aglaoprimnoa stefanii,* new species.

Etymology.—From Greek αγλαος, splendid, stately + *Primnoa,* type genus of Primnoidae, named for Prymno, one of the Oceanids. Gender feminine.

Remarks.—The specimen illustrated by Stibane (1987: pl. 1, fig. 2) as "Gattung *Amphilaphis* . . . mit dichotomer Verzweigung" is strikingly similar to *Aglaoprimnoa.* If the accompanying scale bar is correct, the branches are nearly 1 cm in diameter, much too stout for any known species of *Amphilaphis* (cf. Kükenthal 1924: 288).

Aglaoprimnoa stefanii, new species
Figures 5a–c; 6–14

Material Examined.—Off South Georgia: 54°29'S, 39°22'W, 659–686 m, USNS *Eltanin* sta. 1536, 8 Feb 1966; one colony lacking holdfast, USNM 81287 (SEM 1385–1388, 1403).

Burdwood Bank: 54°41'S, 56°59'W to 54°41'S, 57°03'W, 70 m, USNS ELTANIN sta. 1594, 14 Mar 1966; six more or less complete colonies lacking holdfasts, and three undivided terminal branches, USNM 81288 (SEM 1192, 1193, 1379, 1402, 1415, 1416).

Burdwood Bank: 54°39'S, 57°09'W to 54°39'S, 57°12'W, 124 m, USNS ELTANIN sta. 1596, 14 Mar 1966; 2 colonies, holotype USNM 81289 (SEM 1174, 1175, 1179), paratype USNM 87626.

Diagnosis.—As for the genus.

Description.—Colonies (Fig. 5a–c) are up to 1 m tall, branched three to eight times in an open, lateral manner practically in one plane, with stout whiplike terminal branches up to 60 cm long, mostly about 8 mm in diameter but as much as 10 mm and as little as 5 mm; the first bifurcation occurs from 1.5 to 7 cm above the broken proximal end of the main trunk, commonly 3–5 cm.

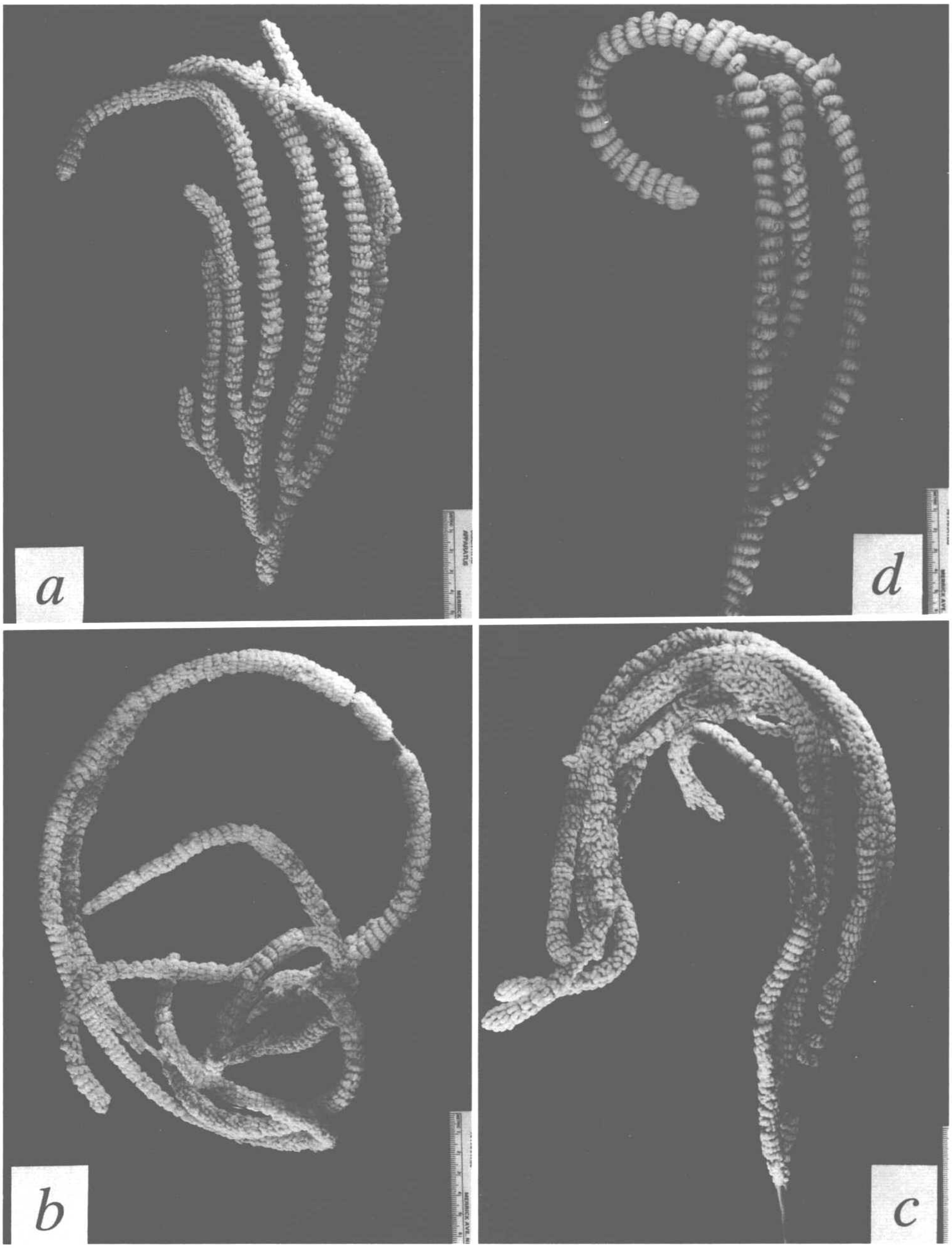

Figure 5. a–c, *Aglaoprimnoa stefanii:* a, USNM 81288; b, USNM 81289 (holotype); c, USNM 81287. d, *Armadillogorgia cyathella.*

The polyps are arranged in closely placed whorls of about 10, bent inward toward the axis and predominantly directed upward, but locally those of one or a few whorls may face downward, and isolated individuals here and there may be oriented in a direction opposite to that of its immediate neighbors; not uncom-

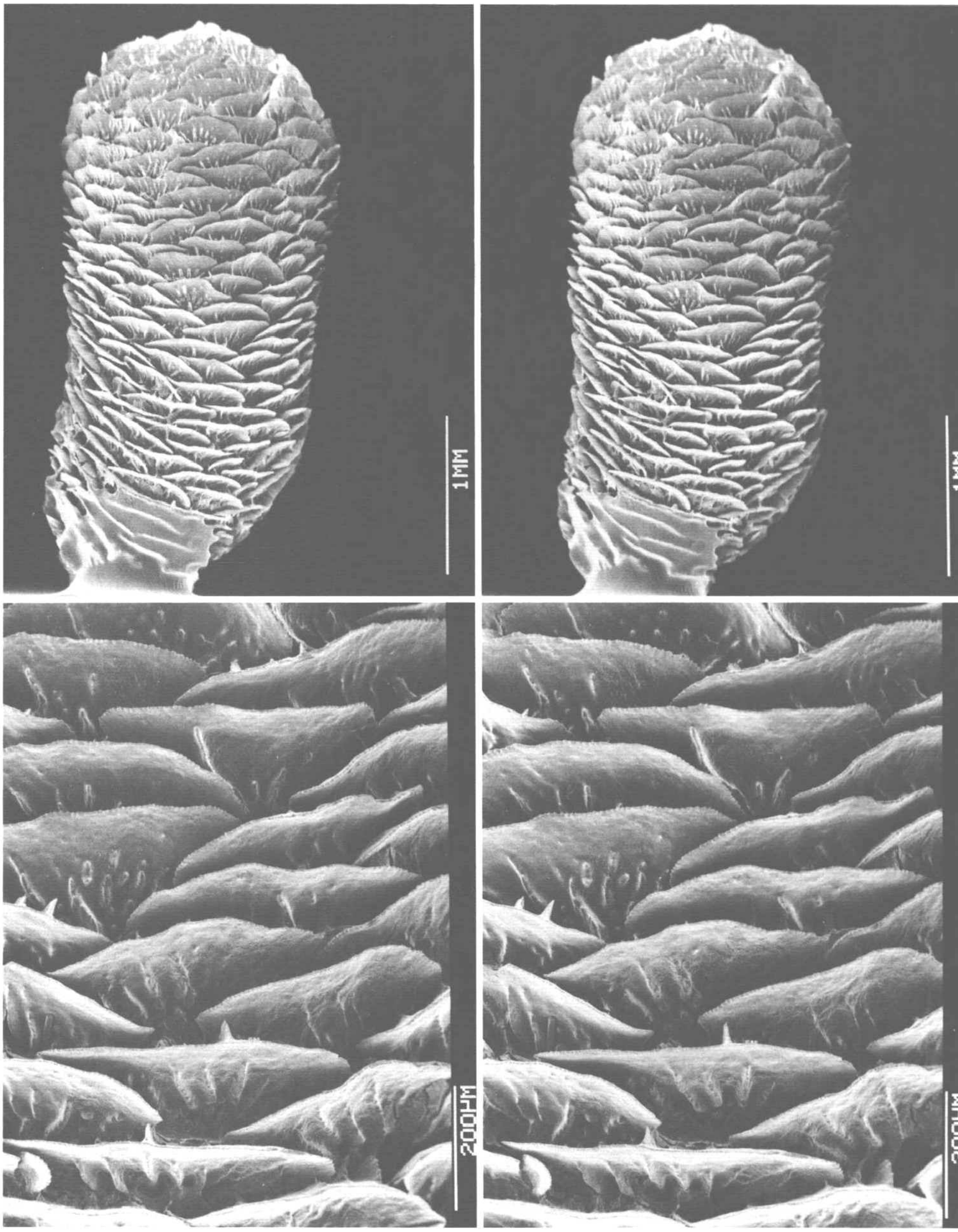

Figure 6. *Aglaoprimnoa stefanii,* USNM 81289. Top, Abaxial view of polyp; Bottom, Detail of abaxial scales in situ. Stereoscopic pairs.

monly the whorls are placed obliquely on the branches, and in some cases they merge so the polyps form spirals for considerable distances. Conspicuous swellings interpreted as brood-chambers are present here and there between the whorls; these are hollow and composed of about four chambers some of which may contain hollow, two-layered oval or spheroidal bodies much distorted by preservation, which appear to be planulae. From 9 to 11 whorls occur in 4 cm of branch

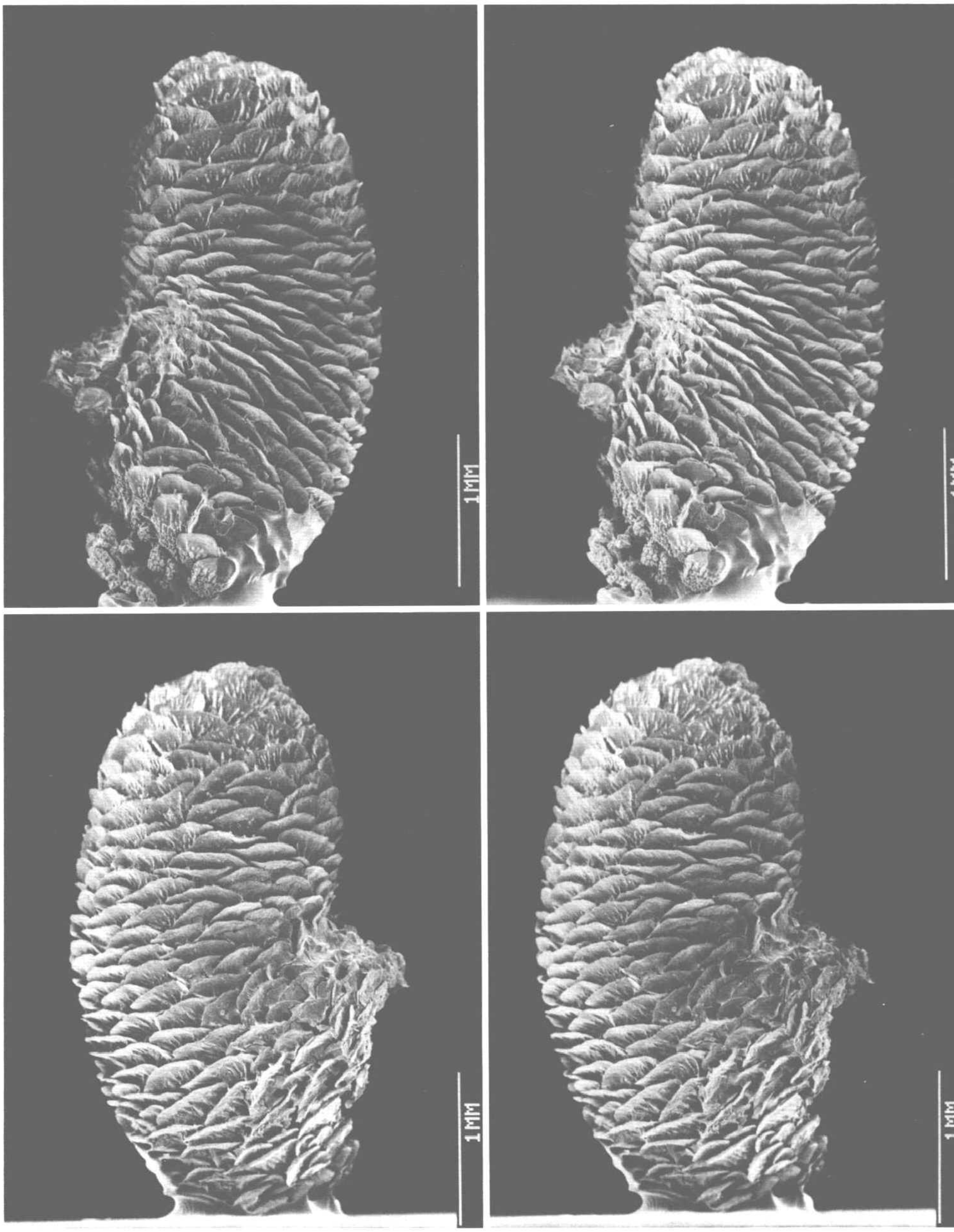

Figure 7. *Aglaoprimnoa stefanii,* USNM 81289. Polyps, side views. Stereoscopic pairs.

length, and new whorls of young polyps may be produced between the fully developed whorls. The polyps of the main trunks appear to be in progressive states of degeneration, the whorls become irregular, and in some places the polyps have been completely resorbed into the coenenchyme.

The polyps (Figs. 6, 7) resemble the cones of a coniferous tree owing to their close covering of broad, fan-shaped scales. In immature polyps the arrangement of the scales retains indications of the original longitudinal rows (Fig. 10), but in

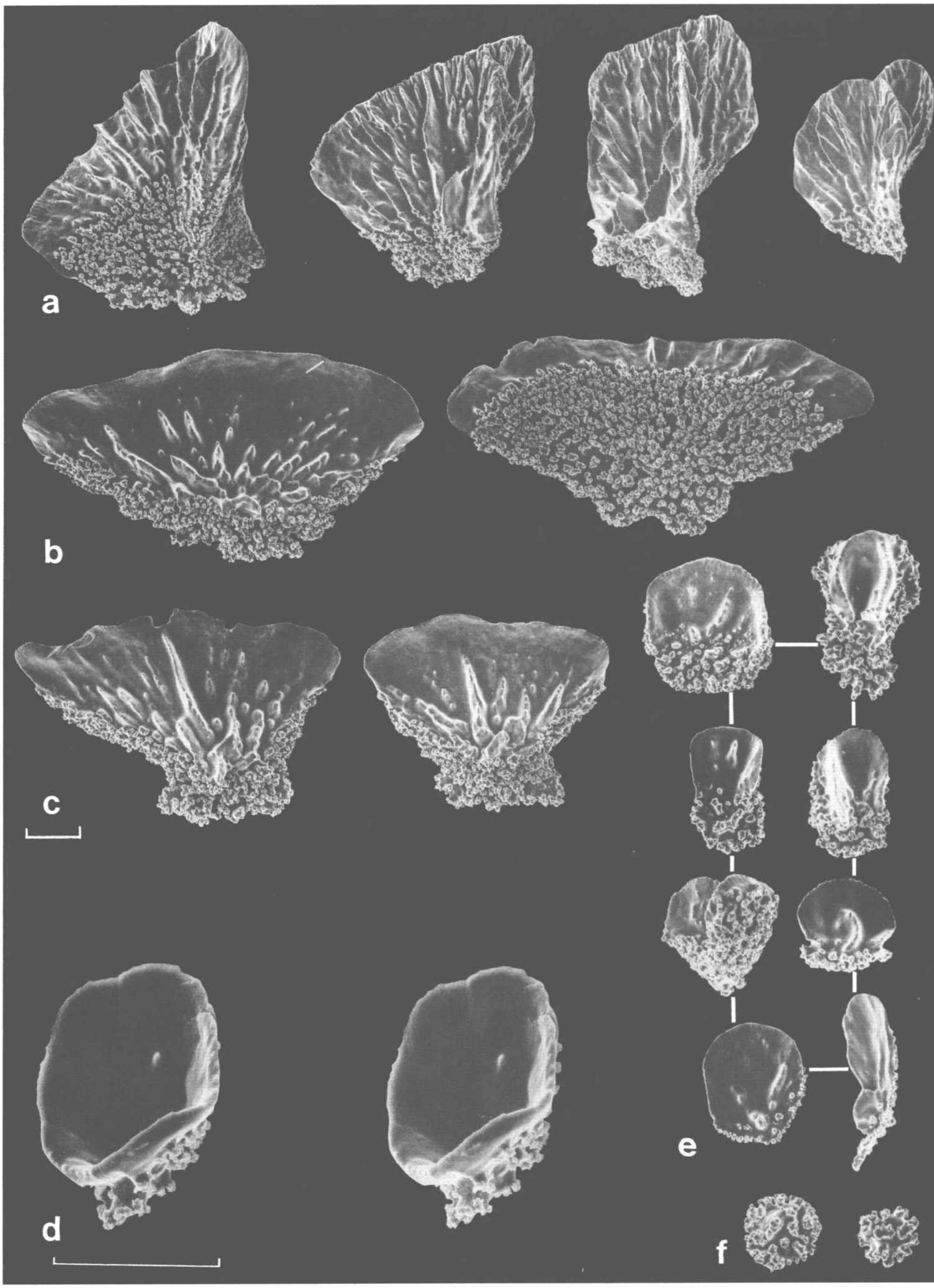

Figure 8. *Aglaoprimnoa stefanii,* USNM 81289, sclerites: a, Circumoral scales; b, Abaxial body scales; c, Proximal body scales; d, e, From outer coenenchyme; f, From inner coenenchyme. d is stereoscopic pair.

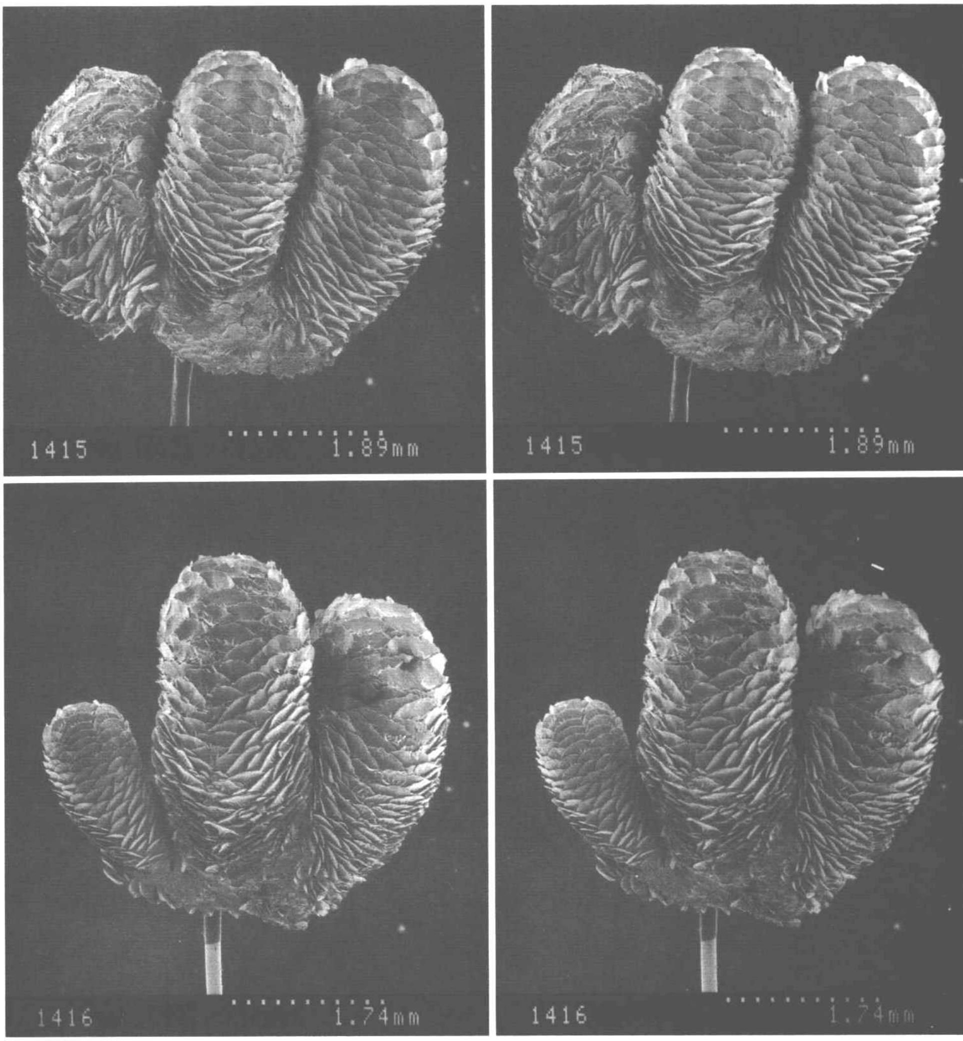

Figure 9. *Aglaoprimnoa stefanii*, USNM 81288. Groups of polyps isolated from whorls. Stereoscopic pairs.

fully developed individuals virtually all traces of longitudinal arrangement has been lost; because of their shape, the scales cannot form regular longitudinal and transverse rows, but are obliquely arranged in such a way that longitudinal alignment becomes irregular and indistinct by insertion of new scales between the original ones (Fig. 7). Consequently, it often is impossible to discern longitudinal rows, and the number appears to vary considerably. The adaxial side of the polyps is shorter than the abaxial but is completely covered by scales.

Most of the body scales (Figs. 8b, 14b) are broadly fan-shaped, externally concave, smooth except for several narrow, sharp crests that radiate upward from the proximal margin, which is closely covered by complex tubercles; the inner surface is convex and covered by complex tubercles except for a wide, smooth distal margin ornamented with several radial crests. The radial crests of the inner

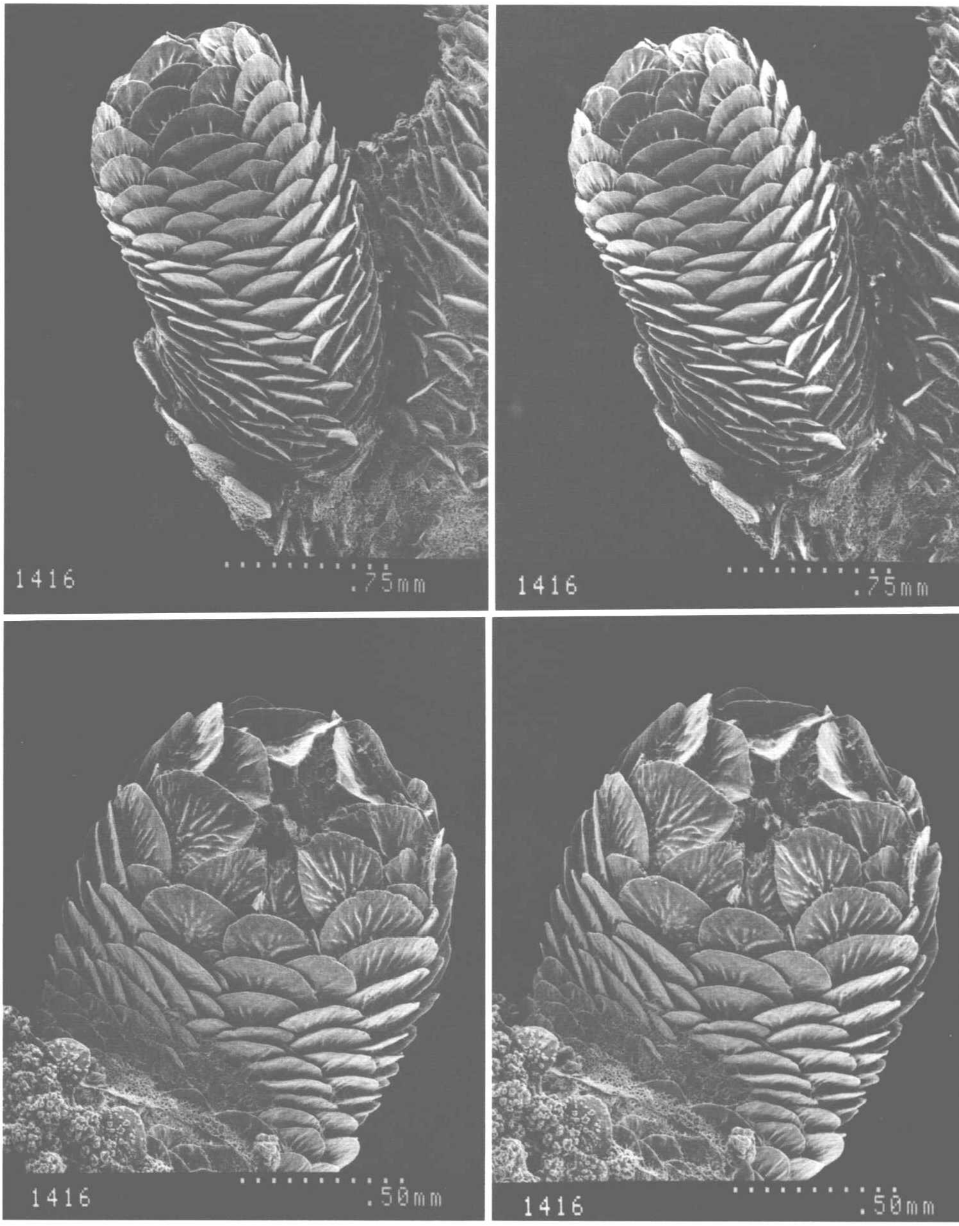

Figure 10. *Aglaoprimnoa stefanii*, USNM 81288. Immature polyp in abaxial and oral views. Stereoscopic pairs.

margin interlock with those of the outer surface of the scales in the transverse row above, apparently serving to prevent lateral displacement during expansion and contraction. Toward the oral end of the polyp the scales become taller than wide (Figs. 8a, 14a), roughly triangular in outline, some symmetrical and some very asymmetrical according to their location, with one or more strong longitudinal crests on the inner (i.e., adoral) side; the complex tubercles are confined to

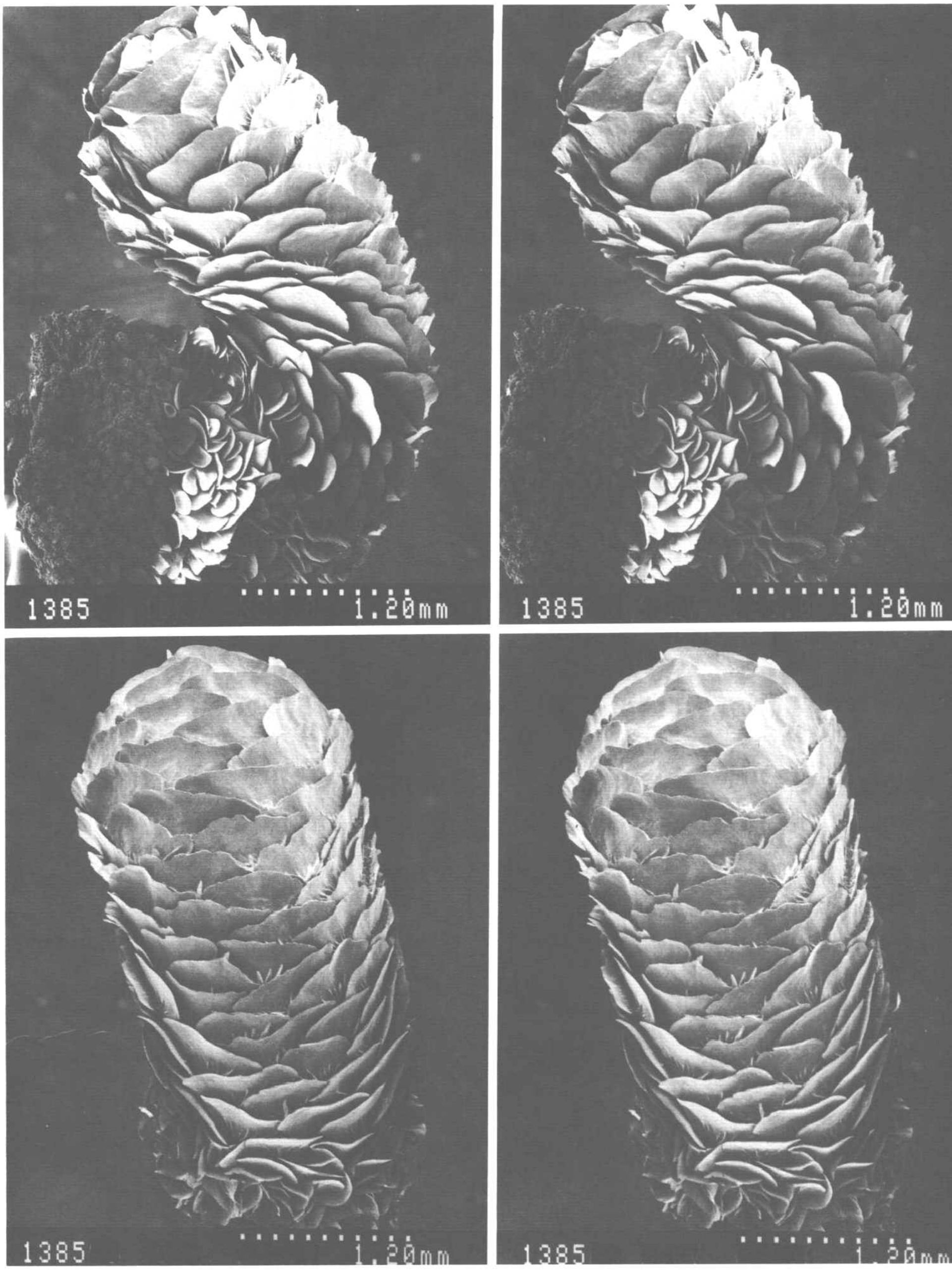

Figure 11. *Aglaoprimnoa stefanii,* USNM 81287. Polyp in lateral and abaxial views. Stereoscopic pairs.

the proximal part of the scale on both surfaces, so the free projecting margin is very wide, 3-flanged, and tapered to a blunt apex. These scales converge toward the distal end of the polyp, closing the apical aperture but not clearly differentiated as a distinct operculum of 8 scales with a regular circle of marginal or circumopercular scales surrounding them (Figs. 10, bottom; 13).

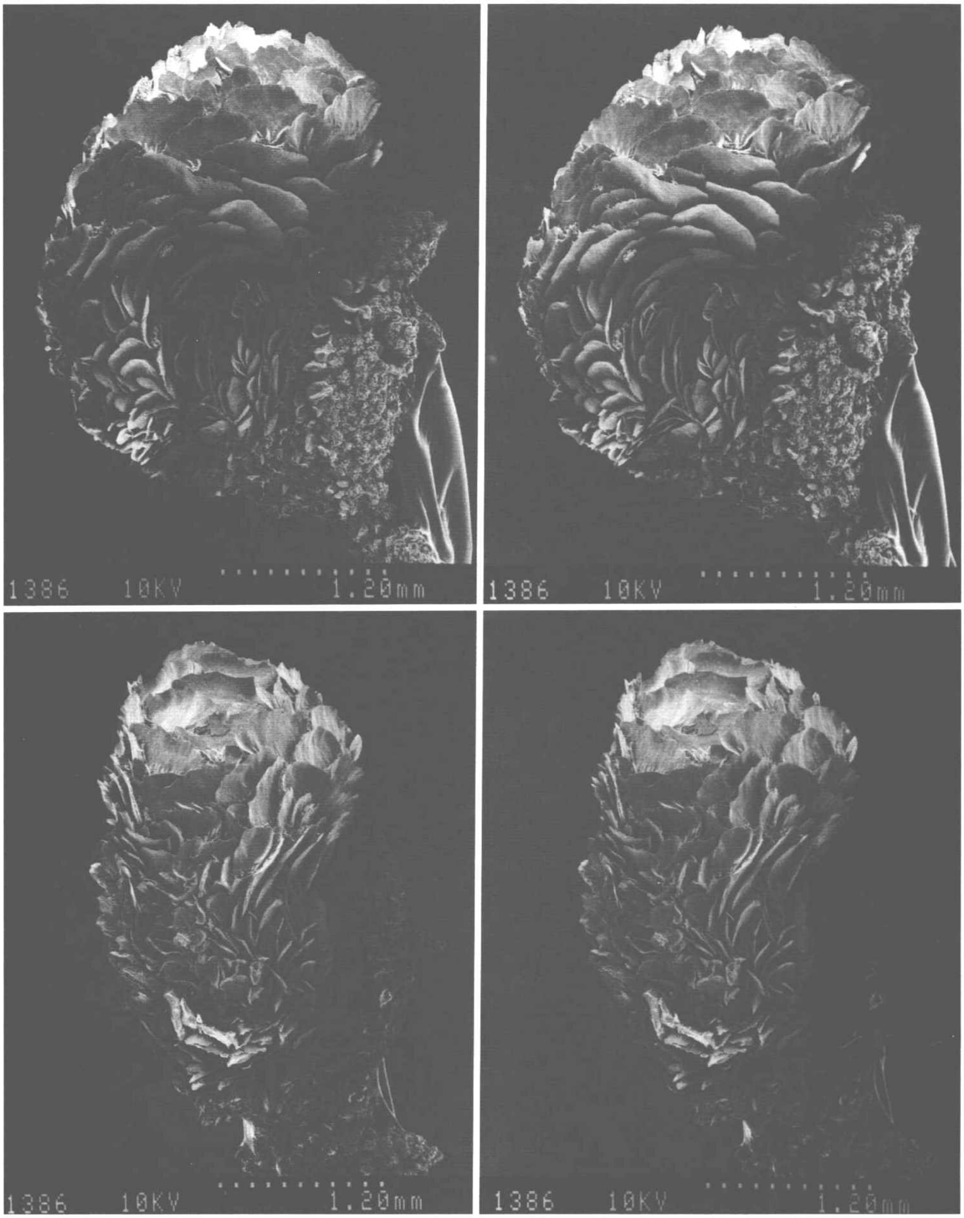

Figure 12. *Aglaoprimnoa stefanii,* USNM 81287. Polyp with scales irregularly arranged, lateral and abaxial views. Stereoscopic pairs.

Near the base of the polyps the scales decrease in size and assume a chalice or bowl shape, concave externally and convex on the inner face, which bears a central cluster of tubercles and often with a ridge or crest dividing the external concavity in two (Figs. 8c, 14c). These sclerites merge with those of the coenenchyme, which is composed of a superficial layer of small sclerites, some more or less "ascus" shaped (Fig. 8d), reminiscent of the "ascus-like or chalice-like scales" described by Thomson and Rennet (1931: 20, pl. 11, figs. 5, 6) as char-

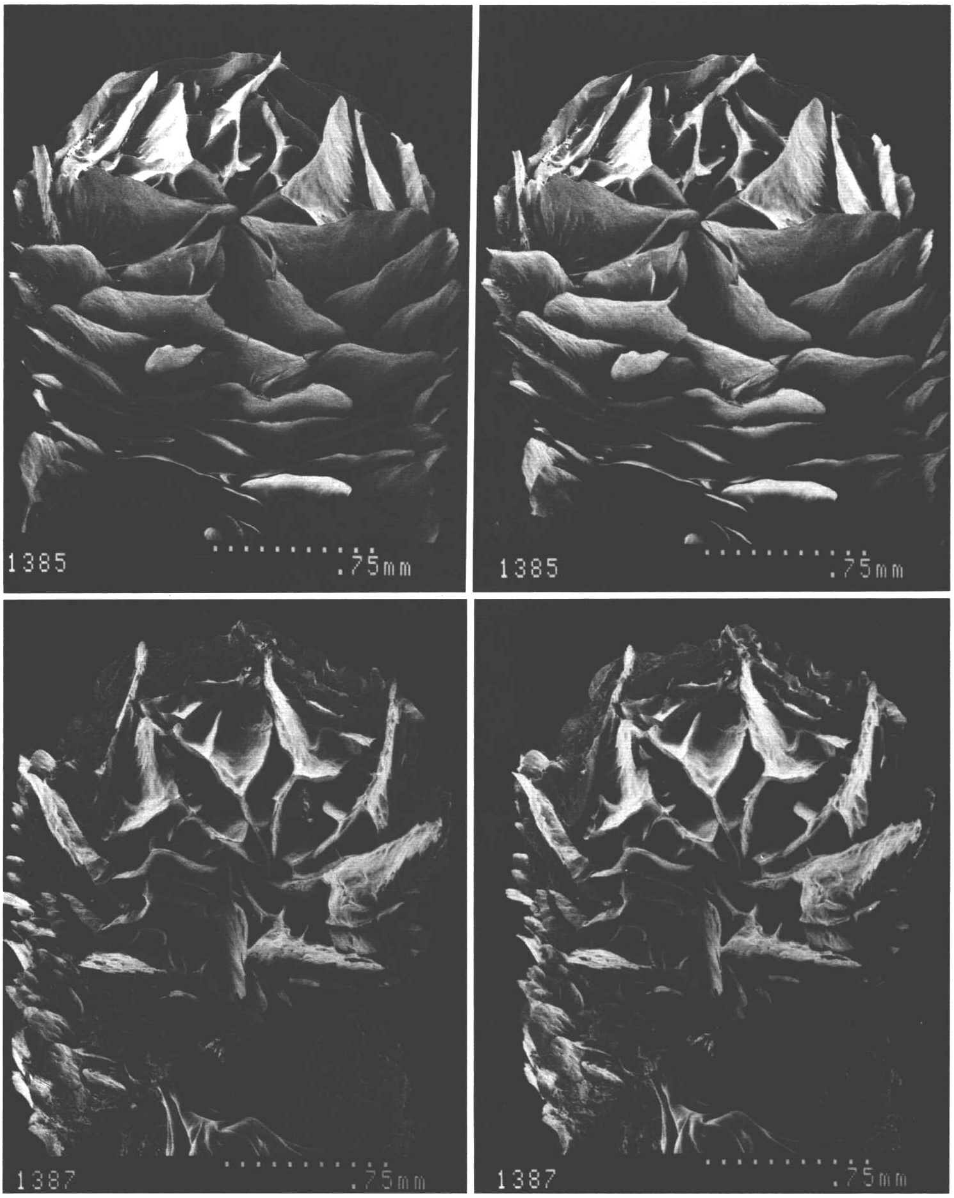

Figure 13. *Aglaoprimnoa stefanii,* USNM 81287. Oral view of polyps showing variation of circumoral scales. Stereoscopic pairs.

acteristic of their new genus *Ascolepis* (=*Fannyella* Gray, 1873. See Bayer 1990). Others with ridges or crests (Figs. 8e, 14d) overlie a thick layer of small tuberculate spheroids (Figs. 8f, 14e), which appear to be derived from a basic capstan-like form.

The polyps have very short tentacles with indications of 8 or 9 pairs of pinnules. In contraction, the tentacles are inverted rather than folded inward over the mouth.

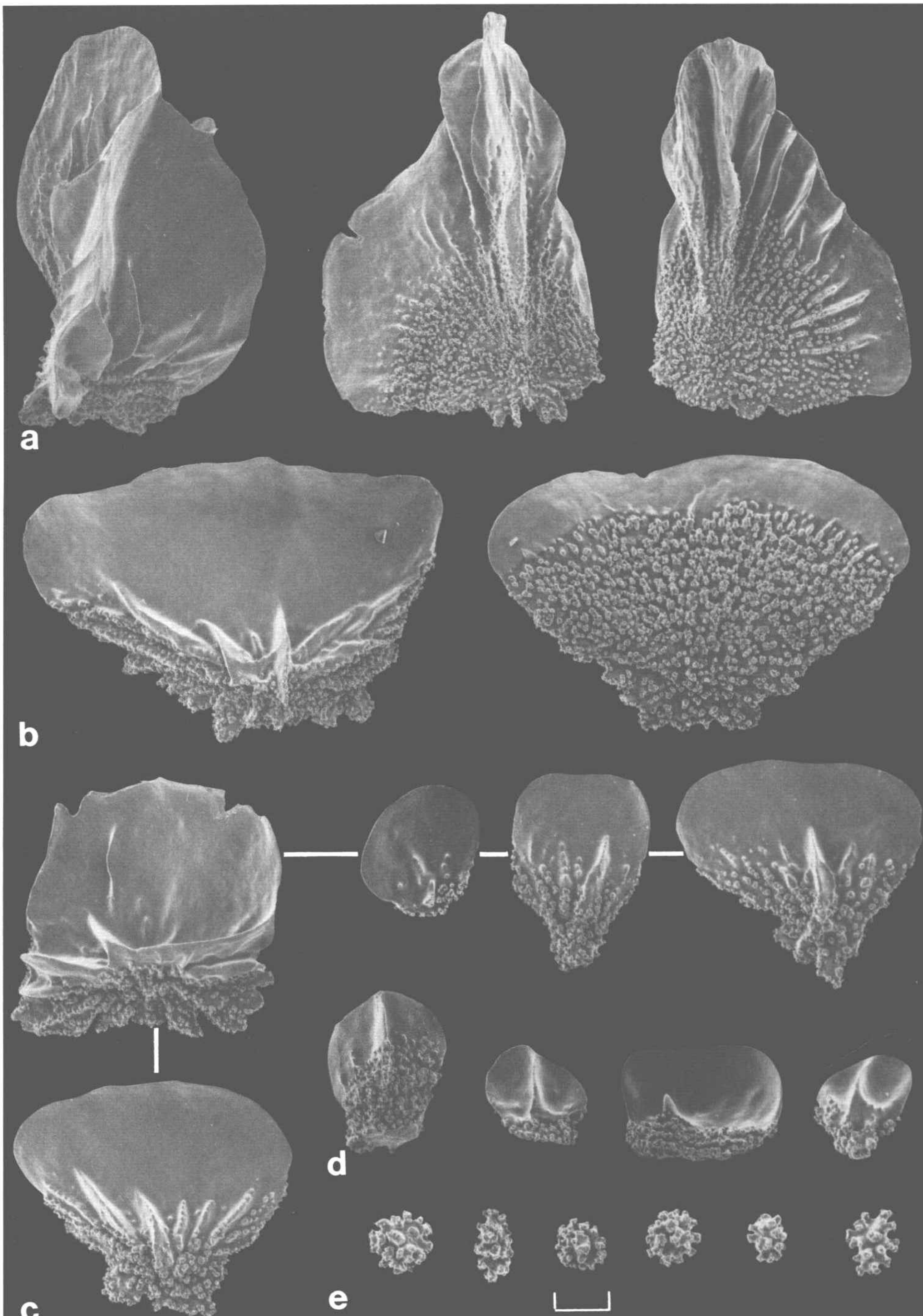

Figure 14. *Aglaoprimnoa stefanii*, USNM 81287, sclerites: a, Circumoral; b, Abaxial; c, Proximal abaxial; d, From outer coenenchyme; e, From inner coenenchyme.

Variation.—The armature of the polyps shows some variation among the colonies. The polyps of USNM 81287 from South Georgia (Figs. 10, 11) have body scales (Fig. 14) larger than those of USNM 81289 from Burdwood Bank (Fig. 8), in some polyps very irregularly arranged (Fig. 12). In the polyps of USNM 81288 (Fig. 9), also from Burdwood Bank, the body scales become larger toward the oral end of the polyps, resembling the specimen from South Georgia, while the proximal part of the polyps corresponds with 81289; even within a single whorl, a polyp with irregularly arranged scales may occur adjacent to individuals having regularly arranged scales (Fig. 9, top).

Etymology.—This species is named for Jeffrey Stefani, former contract investigator and volunteer collaborator in the Department of Invertebrate Zoology, National Museum of Natural History.

Remarks.—Superficially, the colonies resemble those of *Armadillogorgia cyathella* Bayer in size and general appearance, but the shape and arrangement of the body scales of the polyps is entirely different.

Armadillogorgia Bayer, 1980

Armadillogorgia Bayer, 1980:217.
?*Armadillogorgia.*—Stibane, 1987:passim.

Diagnosis.—See Bayer, 1980:217.

Remarks.—It is not possible to determine from the information given whether or not the specimens attributed to this genus by Stibane (1987) belong to it. The low number of sclerites in the abaxial rows suggests that the material may be referable instead to *Primnoella* Gray, 1858.

In fact, it might be argued that *Armadillogorgia* is nothing but an extreme development of the "Compressae" line of *Primnoella,* beginning with species such as *P. delicatissima* Kükenthal, 1909, and *P. polita* Deichmann, 1936, that have rather few sclerites (7–10) in the two abaxial scale rows, through those with many (25–28), such as *P. compressa* Kükenthal, 1908, and *P. scotiae* Thomson and Ritchie, 1906, to *Armadillogorgia* with up to 70. Because the abaxial scales imbricate, they are inserted in the body wall more and more obliquely as the number of scales in the abaxial rows increases, and the exposed part of each scale becomes shorter. With the high number of scales in the abaxial rows of *Armadillogorgia,* the exposed edge of each scale is reduced to a strip much narrower than the part embedded in the mesogloea of the body wall, so that in cross section the sclerite is triangular and becomes a curved prism in consequence of fitting transversely around the body of the polyp. This progression can be seen in even a single polyp of *Armadillogorgia,* as the proximal sclerites in the abaxial rows of some individuals have an almost normal *Primnoella* form; their exposed edges become shorter and shorter distad until the typical sickle-blade shape (Bayer, 1980: fig. 4a) is achieved. However, the numerous small distal sclerites not at all differentiated as operculum and circumoperculum have no counterpart in *Primnoella.*

Armadillogorgia cyathella Bayer, 1980
Figures 5d, 15, 16

Armadillogorgia cyathella Bayer, 1980:217, figs. 1–5.

Material.—Off South Georgia: 54°29'S, 39°22'W to 54°31'S, 39°19'W; 659–686 m. USNS Eltanin

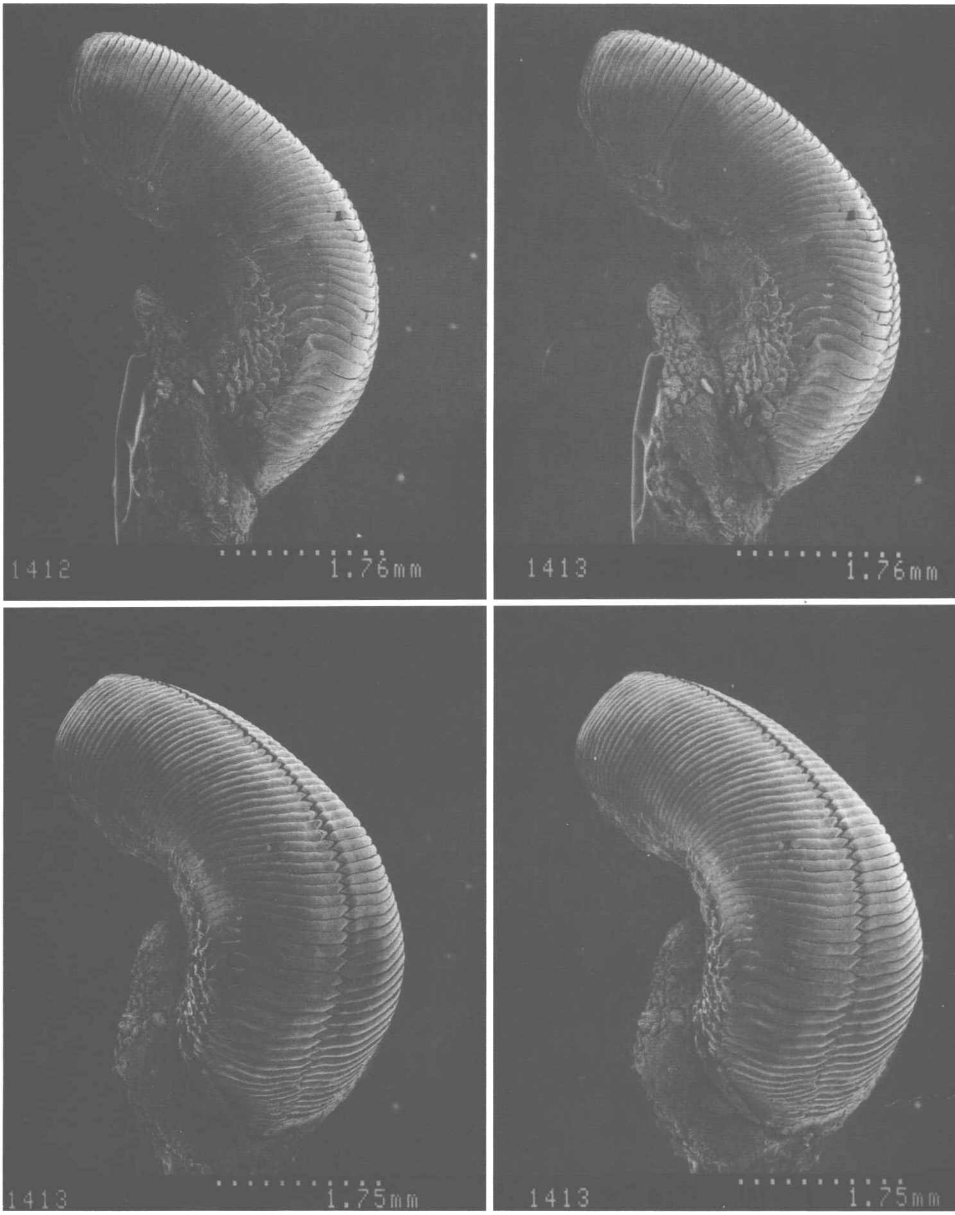

Figure 15. *Armadillogorgia cyathella,* USNM 79591. Polyp in lateral and oblique views. Stereoscopic pairs.

cruise 22, sta. 1536, 8 February 1966. One incomplete colony, holotype, USNM 58166 (SEM 304, 305, 1191); one colony nearly complete but lacking holdfast, topotype, USNM 79591 (SEM 1413).

Scotia Sea: 53°57′S, 55°54′W, 1,879–1,886 m, USNS ELTANIN sta. 377, 21 Dec 1962. Part of terminal branch, USNM 77148 (SEM 1411, 1412).

Diagnosis.—Tall, dichotomously branched Primnoidae having adnate verticillate polyps with only two rows of numerous (up to 70 per row) abaxial narrow, sickle-

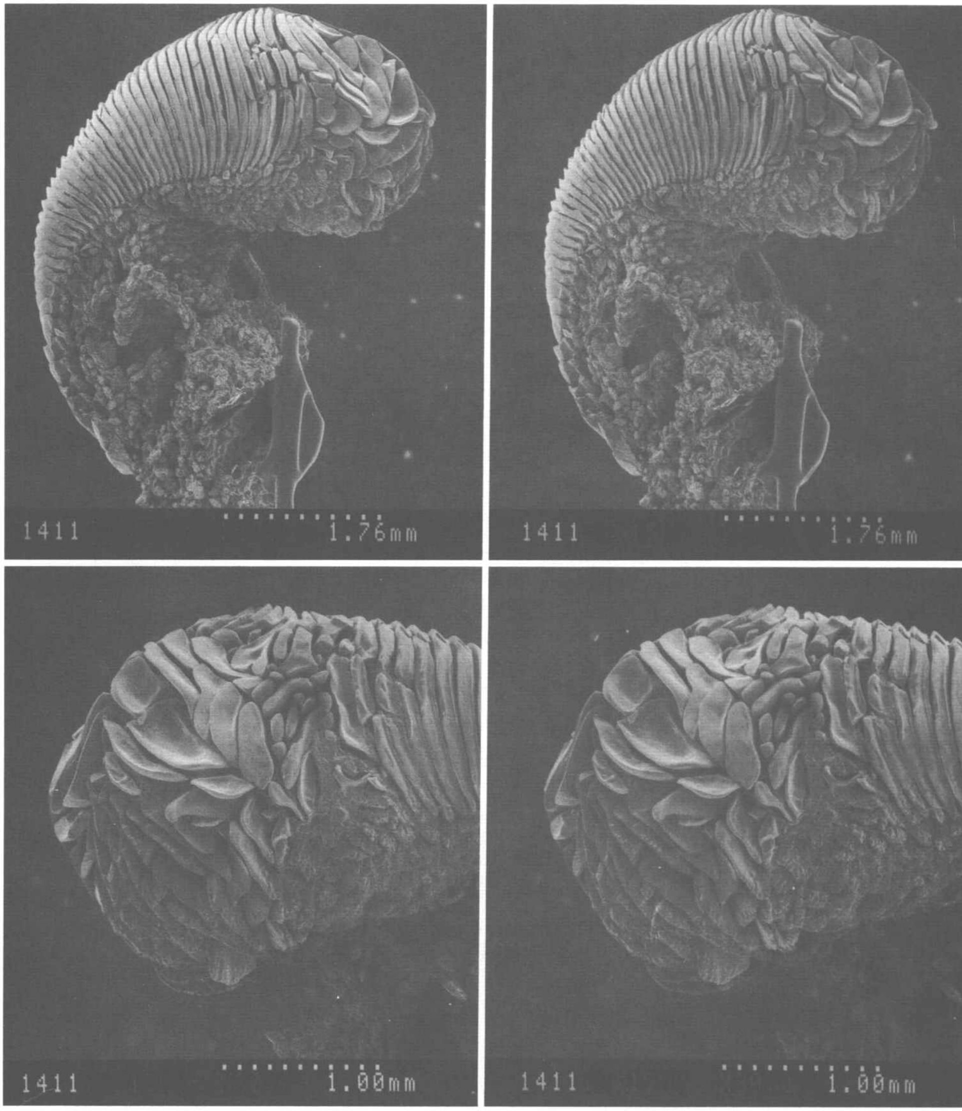

Figure 16. *Armadillogorgia cyathella,* USNM 77148. Polyp, showing repair of damage by sclerites irregularly arranged. Stereoscopic pairs.

blade-shaped prismatic sclerites meeting at a zig-zag abaxial suture; opercular scales not differentiated among many small circumoral scales.

Remarks.—The holotype is an incomplete colony consisting of the main trunk with holdfast and one lateral branch broken off distally at the next point of bifurcation (Bayer 1980: 218, fig. 1). Not available for study when the original description was prepared is another, much better, specimen from the same haul, which permits some minor elaboration of the generic and specific descriptions.

The supplemental specimen (Fig. 5d) appears to be a nearly complete colony save for the holdfast, but there is no evidence that it is part of the holotype colony.

The polyps of the holotype are directed upward, whereas those of USNM 79591 are directed downward save for a few individuals that face upward. The polyps (Fig. 15) do not differ significantly from the holotype, but the sclerites of the abaxial rows are more numerous, up to 70, than in the holotype, which has up to 55.

The polyps show evidence of repair of damage by replacement of sclerites in irregular orientation. One individual had sustained injury to the oral region (Fig. 16), and another to its mid-region.

USNS *Eltanin* sta. 377, from which the fragmentary specimen USNM 77148 was taken, is substantially deeper than the original locality, so a mixing of labels may be suspected. In this specimen, the distal 10 cm of a terminal branch, nearly all of the polyps face upward. The apical whorl is comprised of 5 polyps, the second of 12; the fifth whorl is obliquely set and below this the polyps are arranged in spirals with occasional interruptions, rather than in discrete whorls.

The polyps of all specimens are so similar that there hardly can be any doubt that they represent a single species. Although the orientation of polyps in other genera of Primnoinae tends to be consistently upward or downward at the generic level, localized discrepancies are not uncommon. Except for occasional strays, the polyps face downward in *Narella* Gray, 1870; *Paracalyptrophora* Kinoshita, 1908; and *Arthrogorgia* Kükenthal, 1908; upward in *Callogorgia* Gray, 1858; *Fanellia* Gray, 1870; *Fannyella* Gray, 1873; *Primnoella* Gray, 1858; and *Calyptrophora* Gray, 1866. Therefore it must be assumed that this character is generally but not invariably consistent in most genera but is less firmly fixed in *Armadillogorgia.*

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